Title: CARDIAC DISPLAY METHODS AND APPARATUS
Inventor(s): Laurent Stefani et al.
S/N: 10/722,644   Atty Dkt. No.: 144724 (12553-395)
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EKG gated cardiac scan

Auto transfer to console

Reconstruction of cardiac images at all slices locations and all phases of the cardiac cycle (5% - 95% of the R-R interval). File size around 1000 images.

Transfer of images to workstation

Reconstruction of axial images along the short axis

Review of images to manually find the phase, which represents end systole and end diastole

Manual drawing of myocardial contours at every slice location for ES and ED

$SV = EDV - ESV$

$EF = EDV\text{-}ESV/ESV \times 100\%$

$CO = SV \times HR$

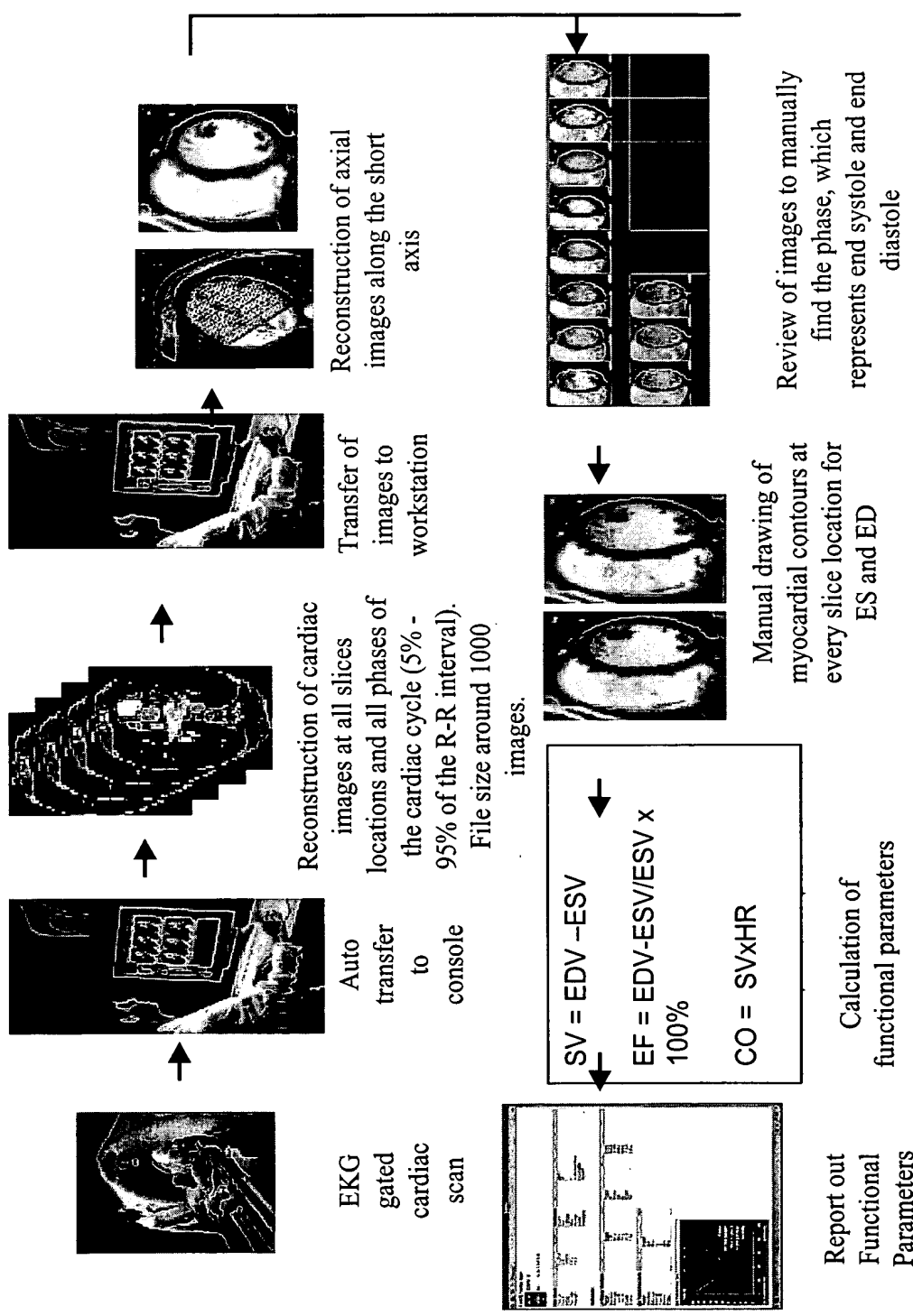Calculation of functional parameters

Report out Functional Parameters

FIG. 1 Typical workflow for current methodologies used to calculate LV functional parameters.

Prior Art

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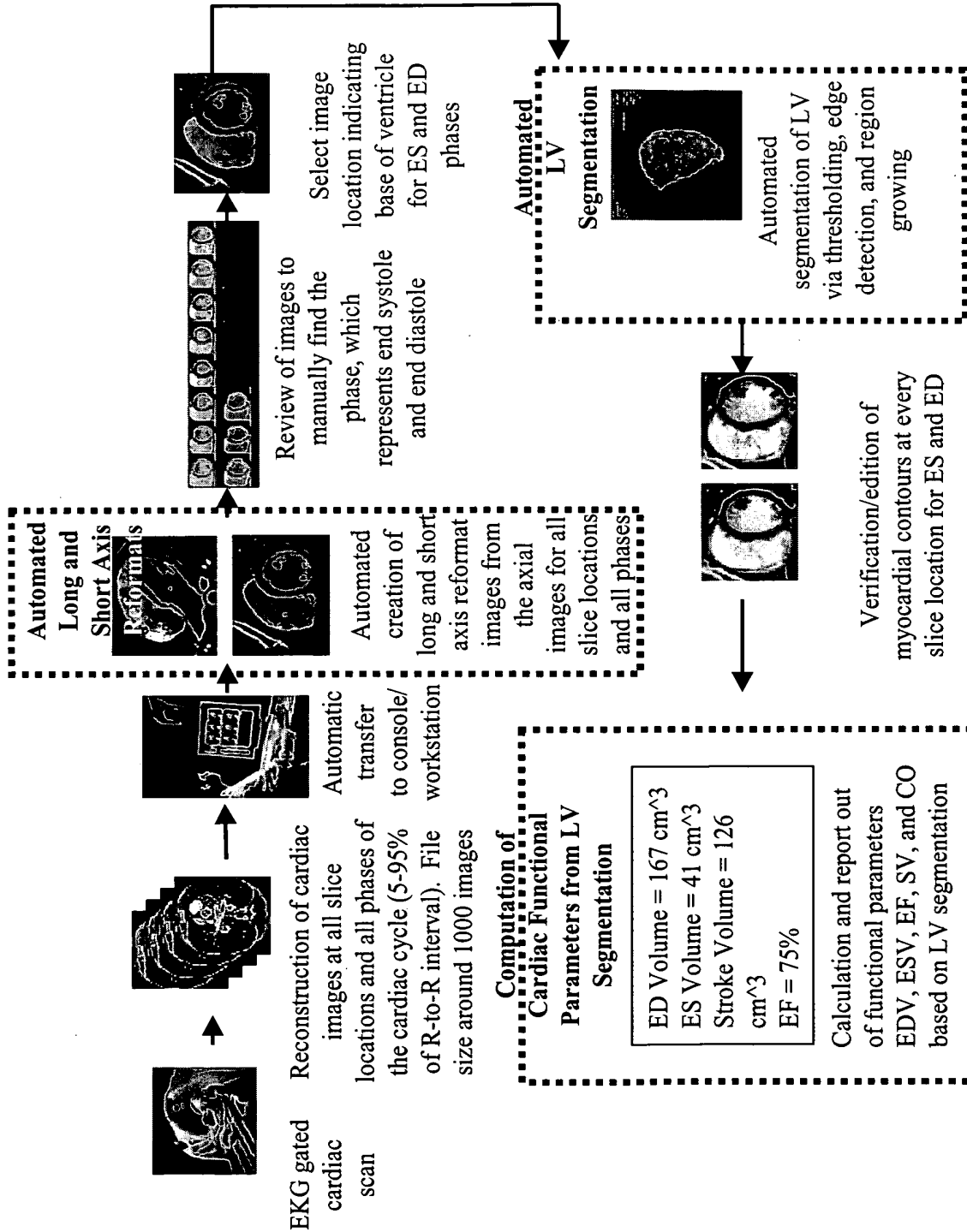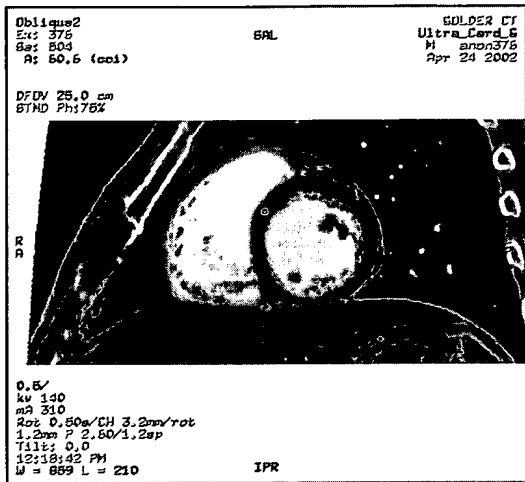Inventor(s): Laurent Stefani et al.
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EKG gated cardiac scan

Reconstruction of cardiac images at all slice locations and all phases of the cardiac cycle (5-95% of R-to-R interval). File size around 1000 images

Automatic transfer to console/ workstation

Automated Long and Short Axis Reformats

Automated creation of long and short axis reformat images from the axial images for all slice locations and all phases

Review of images to manually find the phase, which represents end systole and end diastole

Select image location indicating base of ventricle for ES and ED phases

Automated LV Segmentation

Automated segmentation of LV via thresholding, edge detection, and region growing

Verification/edition of myocardial contours at every slice location for ES and ED

Computation of Cardiac Functional Parameters from LV Segmentation

ED Volume = 167 cm^3
ES Volume = 41 cm^3
Stroke Volume = 126 cm^3
EF = 75%

Calculation and report out of functional parameters EDV, ESV, EF, SV, and CO based on LV segmentation

FIG. 2   New workflow for accurate non-invasive measurement of cardiac function using tomographic images

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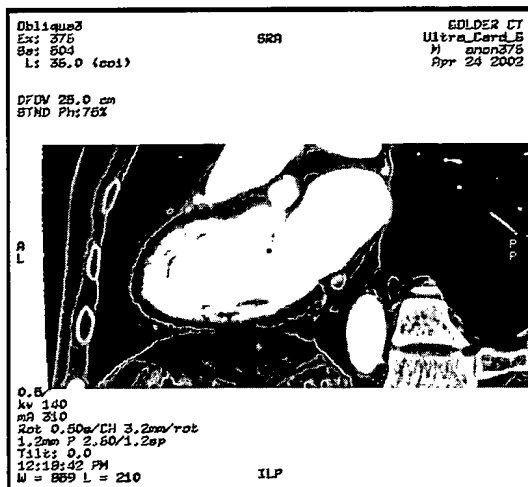Atty: Thomas M. Fisher; Phone: (314) 621-5070
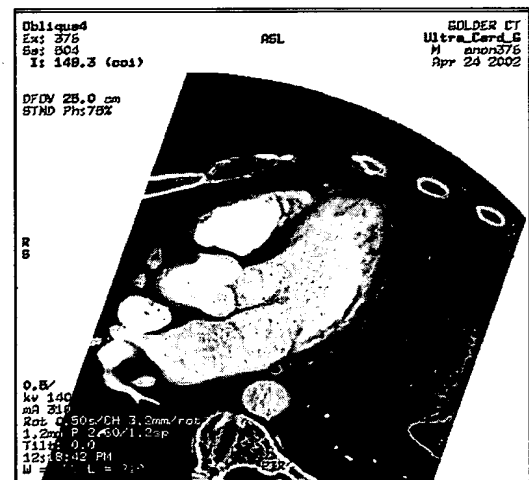
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Short Axis View
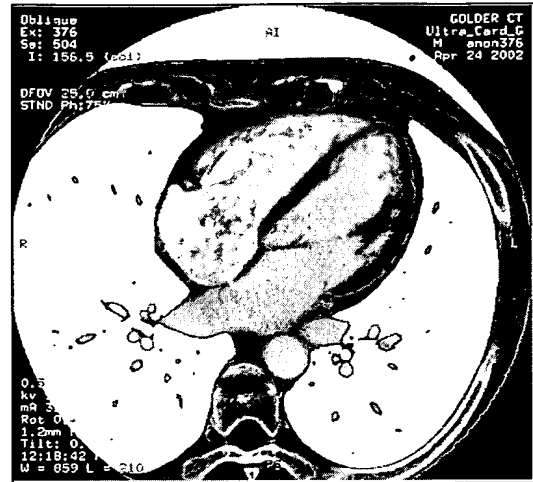
Horizontal Long Axis View
(Four-Chamber View)

Vertical Long Axis
(Two-Chamber View)

LV Inflow/Outflow Tract View

FIG. 3   Representative Short Axis, Vertical Long Axis, Horizontal Long Axis, and Left
Ventricle Inflow/Outflow Tract views from a cardiac CT Exam

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End Systole

End Diastole

Volumes created.
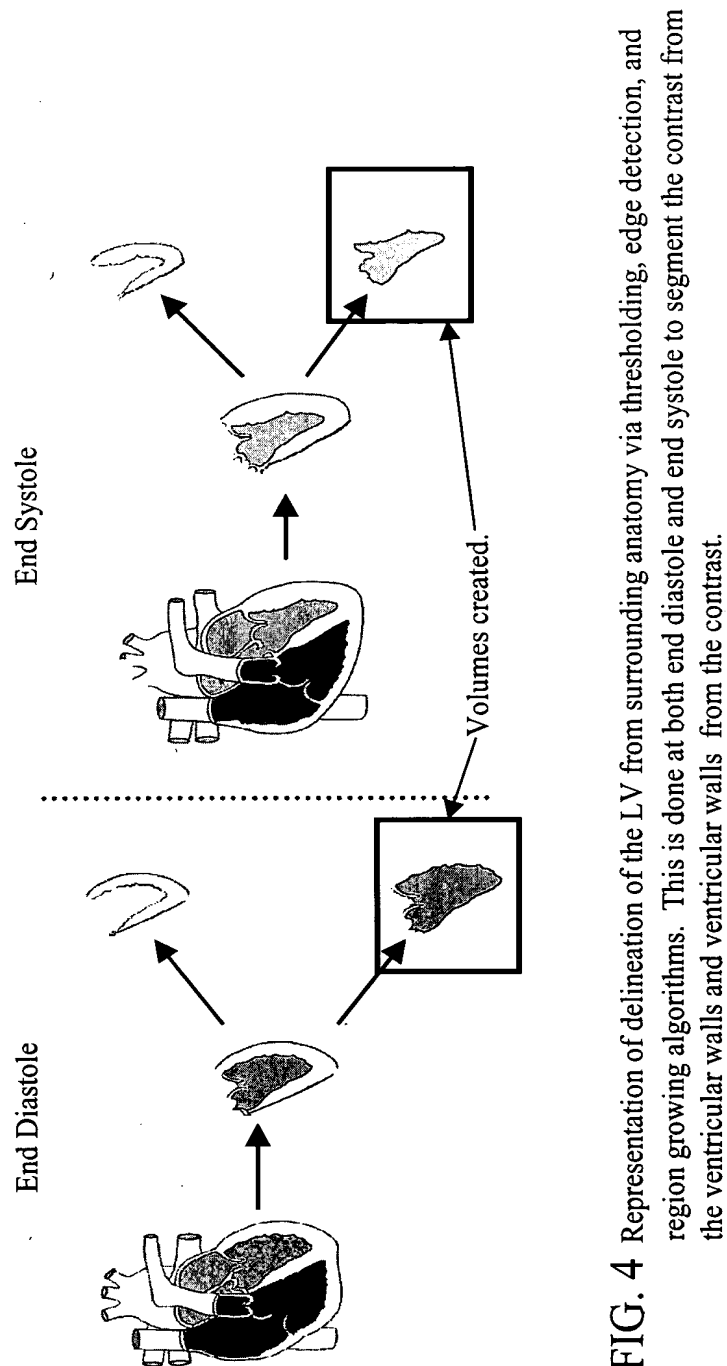
FIG. 4 Representation of delineation of the LV from surrounding anatomy via thresholding, edge detection, and region growing algorithms. This is done at both end diastole and end systole to segment the contrast from the ventricular walls and ventricular walls from the contrast.

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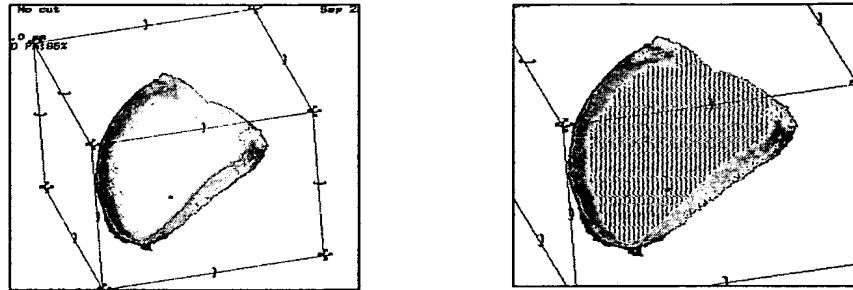
FIG. 5 An optimal combination of advanced algorithms such as thresholding,
morphological and connectivity tools, edge detection, and region growing
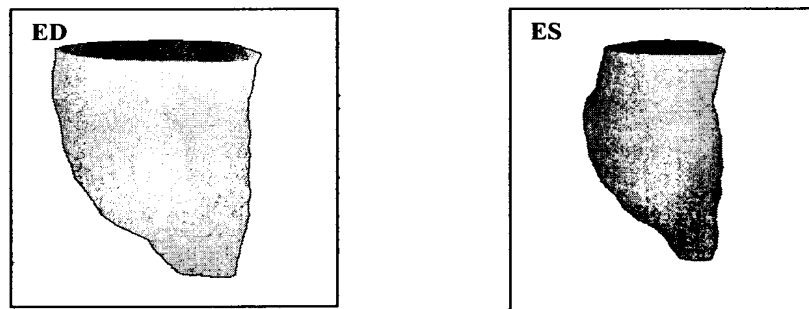are used to segment the contrast within the ventricle from the myocardium.

FIG. 6 Examples of 3D models of the LV at both end systole and end diastole. By
measuring the volume of these models, EDV, ESV, SV, EF, and CO are calculated.

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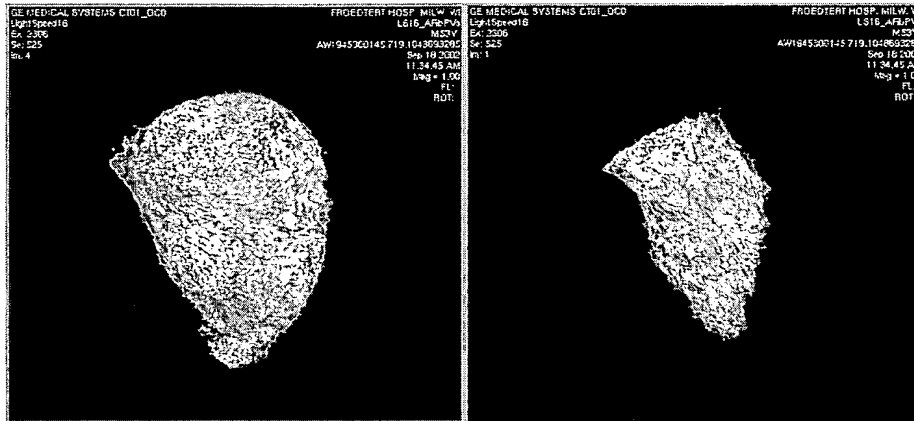
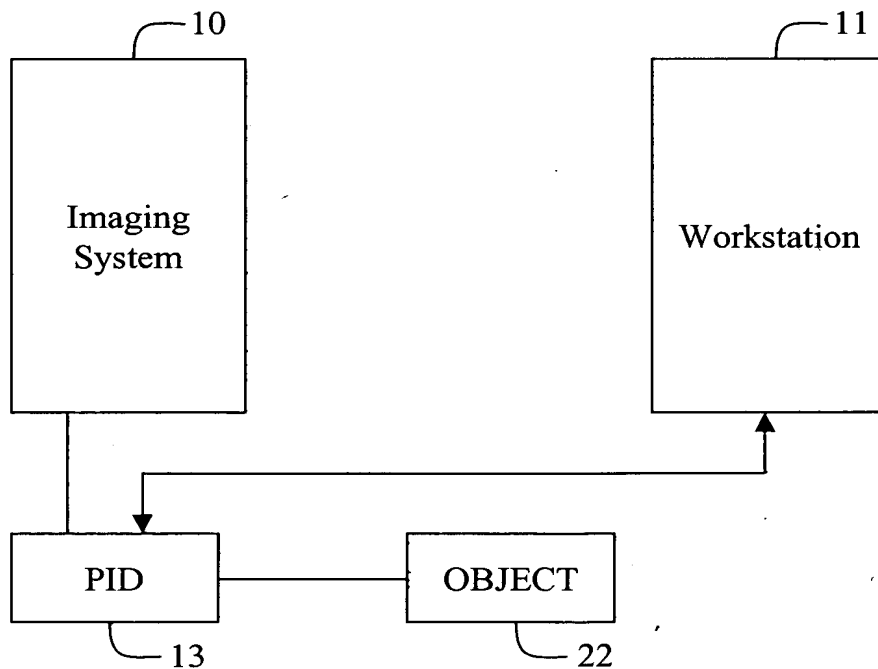**FIG. 7** Volume rendering of the LV contrast at both end diastole and end systole.
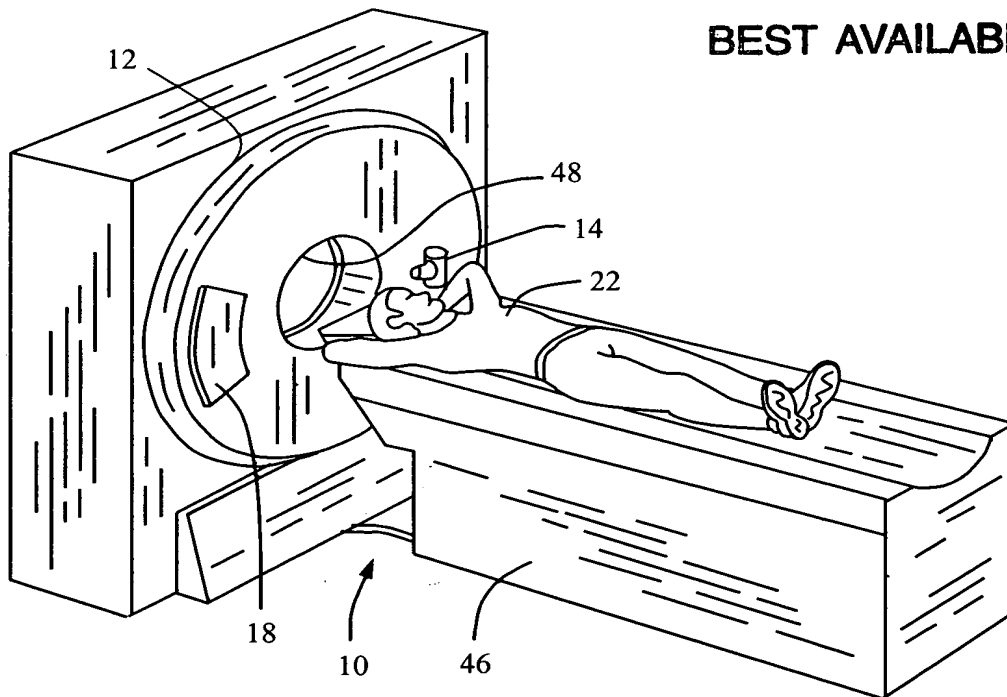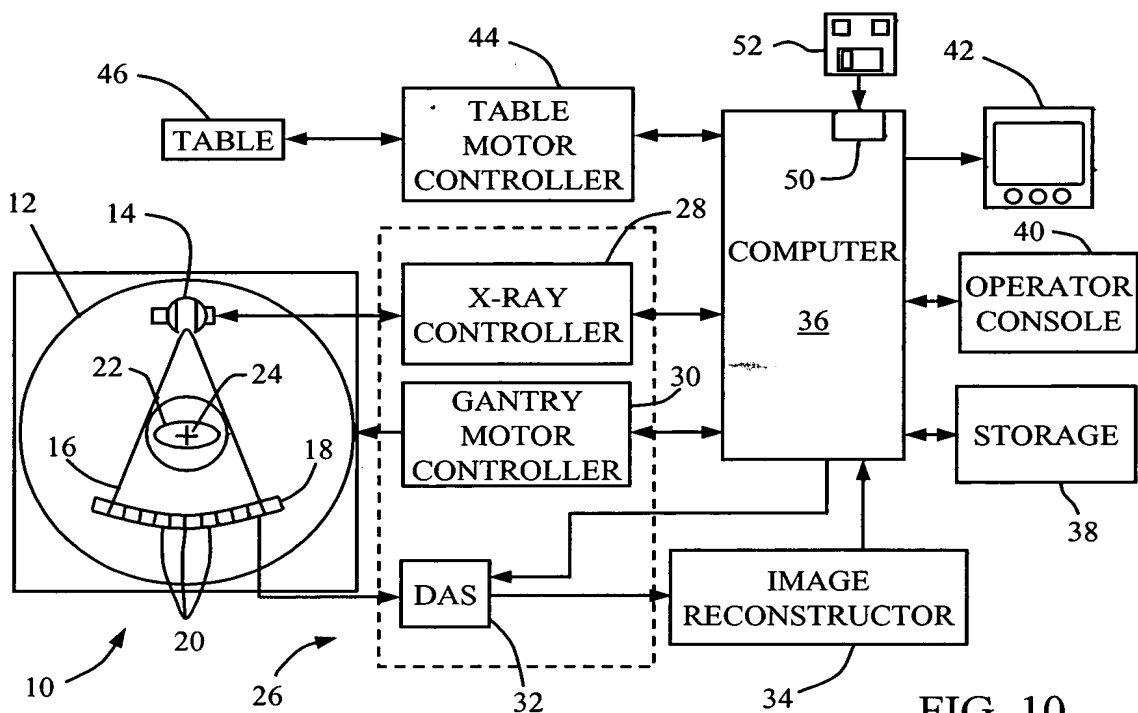

FIG. 8

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FIG. 9

FIG. 10